TECHNOLOGY NEEDS/OPPORTUNITIES STATEMENT

WASTE SEGREGATION AND PACKAGING FOR TRU AND HIGH DOSE RATE CONTAMINATED MATERIAL

Identification No.: RL-SS50
Date: March 2001

Program: Environmental Restoration
OPS Office/Site: Richland Operations Office/Hanford Site
Operable Unit (s): 300-FF-2
PBS No.: RL-RS01 (RL-ER03)
Waste Stream: (Disposition Map Designation: T3-ER [technical risk score 5])
TSD Title: N/A
Waste Management Unit (if applicable): N/A
Facility: N/A

***Priority Rating*:**

This entry addresses the "Accelerated Cleanup: Paths to Closure (ACPC)" priority:

_X_ 1. Critical to the success of the ACPC
____ 2. Provides substantial benefit to ACPC projects (e.g., moderate to high lifecycle cost savings or risk reduction, increased likelihood of compliance, increased assurance to avoid schedule delays)
____ 3. Provides opportunities for significant, but lower cost savings or risk reduction, and may reduce uncertainty in ACPC project success.

***Need Title*:** Waste segregation and packaging for TRU and high dose rate contaminated material

Need/Opportunity Category: Technology Need

***Need Description*:** Technologies are needed to segregate contaminated material retrieved from the burial grounds based on waste designation, and package each material appropriately for transportation away from the burial ground. Techniques need to include appropriate characterization to segregate waste for packaging according to the criteria for final disposition (e.g., waste acceptance criteria). The technologies must provide or be compatible with remote handling techniques to perform segregation and packaging of contaminated material. Additionally, the technology must provide or be compatible with techniques for environmental control (spreading and shielding) of contaminated material.

Schedule Requirements:

Earliest Date Required: 9/30/04

Latest Date Required: 9/30/12
Remedial design for the burial grounds is scheduled to begin in 2005.

***Problem Description*:**
This need pertains to two burial grounds located north of Hanford's 300 Area. A summary of the construction and waste contents for each burial ground are described below.

618-10 Burial Ground
The 618-10 burial ground is approximately 148 m by 143 m (485 ft by 470 ft) oriented northwest by southeast and consists of 12 trenches and 94 vertical pipe units. The vertical pipe units were constructed from six 208-L (55-gallon) drums welded together end-to-end. The trenches were constructed with dimensions ranging from 15 m to 98 m (50 ft to 320 ft) in length and 12 m to 21 m (40 ft to 70 ft) in width; depth of the trenches was 7.6 m (25 ft). The burial ground has been stabilized with a cover of clean fill.

The 618-10 burial ground received high-level, low-level, and TRU waste. Until 1960 some high-level and TRU wastes were disposed of in cardboard containers with contact doses up to 500 R/h, although most high-level waste was interred in concrete-filled 208-L (55-gallon) drums. After 1960, the high-level waste was packaged in "milk pail" disposal cans and interred in the vertical pipe units. Total TRU estimate for the 618-10 site is one to two kg dispersed throughout the site. During stabilization activities at the site in 1983, a quantity of oil appeared on the surface after heavy equipment drove over a portion of the site.

618-11 Burial Ground
The 618-11 burial ground is approximately 114 m by 305 m (375 ft by 1000 ft) oriented east-west and consists 3 trenches, 50 vertical pipe units (constructed from six 208-L (55-gallon) drums welded together end-to-end), and five 2.4-m- (8-ft) diameter caissons (constructed from 3-m (10-foot) lengths of eight-gauge corrugated steel pipe). The trenches were 274 m (900 ft) long and 15 m (50 ft wide); depth of the trenches was 7.6 m (25 ft). The burial ground has been stabilized with a cover of clean fill.

The 618-11 burial ground received high-level, low-level, and TRU waste. As in the 618-10 burial ground, some high-level and TRU wastes were disposed of in cardboard containers with contact doses up to 500 R/h, although most high-level waste was interred in the vertical pipe units and, after June 1964, in the caissons. Waste materials in vertical pipe units and caissons may be packed inside cans of various sizes (e.g., 1-L, 19-L, 57-L [quart, 5-gallon, 15 gallon]). Some TRU waste was encased in concrete for disposal to burial ground trenches. Total TRU estimate for the 618-11 site is five to ten kg dispersed throughout the site.

Chemical species in the burial grounds may include solid metallic sodium, beryllium residues, contaminated lead shielding, technetium oxide, promethium oxide, zirconium cladding, potentially pyrophoric metal turnings, thorium oxide, other thorium compounds, and uranium compounds. Radioactive isotopes may include ^{14}C, ^{60}Co, ^{65}Zn, ^{90}Sr, ^{103}Ru, ^{131}I, ^{137}Cs, ^{144}Ce, ^{147}Pm, ^{226}Ra, ^{232}Th, ^{233}U, ^{235}U, ^{237}Np, ^{238}U, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Am, and ^{244}Cm.

Additional information about the wastes in the 618-10/11 burial grounds is described in "Characterization of the 618-11 Solid Waste Burial Ground, Disposed Waste, and Description of the Waste-Generating Facilities", 1997, Waste Management Federal Services, Richland, WA, HNF-EP-0649, Rev 0.

It is anticipated that burial ground remediation will be implemented through the following major steps.

- Delineation of burial-ground boundaries
- Pre-excavation waste identification for site excavation planning
- Excavation, characterization & segregation - technologies will be needed for remote handling, field characterization, environmental controls, and waste segregation during excavation operations to minimize worker exposure and environmental hazards
- Waste handling and transport – technologies will be needed for characterization, segregation, and packaging of the excavated waste in a form suitable for transport away from the burial ground area
- Final disposal

Benefit to the Project Baseline of Filling Need: As identified in the Technology Alternatives Baseline document for the 618-10/11 burial grounds (BHI-01484, http://www.bhi-erc.com/library/bhi/bhi01484.pdf), there are currently technology gaps associated with appropriate waste handling and packaging technologies for materials retrieved from the 618-10/11 burial grounds. Development of suitable technologies is needed as part of identifying the most effective technical approach for burial ground remediation.

***Functional Performance Requirements*:** The technology must be able to operate in a burial ground environment. Technologies are needed that can segregate and package waste including boxed waste (potentially damaged), debris of variable size and shape, and contaminated soils. Technologies are also needed that can segregate and package waste from the caissons and from the vertical pipe units described in the Problem Description. The technology must provide or be compatible with techniques for physical containment and shielding of the waste. The technologies must also provide appropriate characterization to determine waste designation for packaging according to waste acceptance criteria for final disposition (e.g., WIPP).

Work Breakdown Structure (WBS) No.* :** 1.4.03.2.1 (RL-RS01) ***TIP No.: TIP 0003

Relevant PBS Milestone: PBS-MC-028, M-16-00B

***Justification For Need*:**

Technical: The Technology Alternatives Baseline document prepared for the 618-10/11 burial grounds identified that technologies directly suitable for waste handling and packaging during excavation of high dose rate and TRU materials in burial ground environments were not available.

Regulatory: Transportation requirements and Waste Acceptance Criteria at disposal sites will require specific waste handling and packaging for TRU and high dose rate material.

Environmental Safety & Health: Worker safety and requirements for handling high dose rate and TRU materials will require specific waste handling and packaging for TRU and high dose rate material.

Potential Life-Cycle Cost Savings of Need (in $000s) and Cost Savings Explanation: This need is for an enabling technology with a primary benefit of reducing worker risk.

Cultural/Stakeholder Concerns: The primary concern related to this need is ensuring the safety of workers, the public, and the environment during burial ground remediation operations.

Other: None

Current Baseline Technology: N/A

End-User: Richland Environmental Restoration Project

Site Technical Point-of-Contact: Scott W. Petersen, BHI, (509) 372-9126; Richard A. Carlson, BHI, (509) 372-9632; Michael J. Truex, PNNL, (509) 376-5461

Contractor Facility/Project Manager: Vern R. Dronen, BHI, (509) 372-9075

DOE End-User/Representative Point-of-Contact: Robert G. McLeod DOE, (509) 372-0096

INTEGRATED NEEDS FOR GROUNDWATER/VADOSE ZONE INTEGRATION PROJECT – FY02

The Integration project Needs were updated by updating references and schedules. Other minor changes are highlighted in yellow.

The Groundwater/Vadose Zone Integration Project (Integration Project) worked with the core projects in FY99 to prepare Integrated Needs for those needs associated with the characterization and assessment of the contaminant inventory, vadose zone, groundwater, and river systems. In FY00, a similar process was used to develop 4 additional Integrated Needs for risk assessment and to make minor revisions to the needs developed in FY99. These needs were updated in FY01 and in FY02. The Integrated Needs reflect the roadmap scope and collect the Science and Technology (S&T) needs prepared by the core projects and the Integration Project into 19 types of needs.

ERC Need Statements Associated with Hanford's Groundwater/Vadose Zone Integration Project

Hanford's Integration Project (Integration Project) divides its work into eight technical elements. In addition to these technical elements, a System Assessment Capability is being developed by the Integration Project as the means to coordinate and collectively analyze the information from the other technical elements. The eight technical elements are:

- **Vadose Zone**
- **Groundwater**
- **River**
- **Inventory**
- **Risk**
- Monitoring
- Regulatory Path
- Remediation Options.

Of the eight technical elements that are part of the Integration Project, four of the elements highlighted in the bullets above (Vadose Zone, Groundwater, River, and Inventory) were addressed in detail in Rev. 0 the Integration Project Roadmap (DOE/RL-98-48). In FY00, the project added a detailed description of the Risk technical element within the update of the Integration Project S&T Roadmap (Rev. 1). The FY02 needs associated with the Integration Project remain essentially unchanged and continue to be aligned with the technical content of these five technical elements. Some of the technology needs and science needs being carried forward to FY02 align with the Remediation Options technical element because the scope of this technical element includes the current remedial actions of the Environmental Restoration Contractor (ERC). Additional detail on the Remediation technical elements will be added during FY02 as the Integration Project updates the S&T roadmap to Rev. 2. In addition to adding the remediation technical element, the roadmap will be updated to address comments by the National Research Council/National Academy of Sciences committee that recently completed its review of the Integration Project S&T as well as initial results of the System Assessment Capability.

The S&T needs statements will be revised during FY02 update of the roadmap. The Monitoring technical element is currently planned for inclusion in Rev. 3 of the S&T roadmap during FY03.

Table 1 lists the FY 2002 needs (in bold type) and detailed needs as they relate to the technical elements of the Integration Project. Needs related to the other technical elements will be added later after the roadmapping process is completed in FY02. The Integration Project needs are grouped by the technical element to which they align as shown in the Table 1.

Table 1. Integration Project Technical Elements and Corresponding Hanford Needs.

Vadose Zone	Groundwater	River	Inventory	Risk	Remediation Options
RL-SS27	**RL-SS32**	**RL-SS36**	**RL-SS40**	**RL-SS43**	RL-SS01
RL-SS28	RL-SS03	**RL-SS37**	RL-WT01	**RL-SS44**	RL-SS02
RL-SS23-S	RL-SS06	**RL-SS38**	RL-WT070	**RL-SS45**	RL-SS03
RL-SS24-S	**RL-SS33**	**RL-SS39**	RL-WT090	**RL-SS46**	RL-SS04
RL-SS26-S	RL-SS25		RL-WT091		RL-SS05
RL-SS27-S	**RL-SS34**		**RL-SS42**		RL-SS06
RL-SS30-S	RL-SS23-S		RL-WT068		RL-SS07
RL-WT035-S	RL-SS24-S				RL-SS08
RL-WT053-S	RL-SS25-S				RL-SS09
RL-SS29	RL-SS26-S				RL-SS10
RL-SS28-S	RL-SS27-S				RL-SS11
RL-SS29-S	RL-SS28-S				RL-SS12
RL-SS31-S	RL-SS31-S				RL-SS13
RL-SS35-S	RL-SS32-S				RL-SS14
RL-WT053-S	RL-SS35-S				RL-SS15
RL-WT044-S	**RL-SS35**				RL-SS16
RL-SS30					RL-SS17
RL-WT044-S					RL-SS18
RL-WT035-S					RL-SS19
RL-SS31					RL-SS20
RL-SS25-S					RL-SS23
RL-SS37-S					RL-SS24
RL-SS25					RL-SS25
RL-SS26					RL-SS26
RL-WT102					RL-WT017
RL-WT026					RL-WT018
					RL-WT061
					RL-SS33-S

					RL-SS34-S
					RL-SS36-S
					RL-WT046-S

Vadose Zone Element Index to Linked Needs.

RL-SS27	Use of Field Data from Representative Sites to Elucidate Controlling Features and Processes for Contaminant Distribution
RL-SS28	Understand, Quantify and Develop Descriptions of Reactions and Interactions between Contaminants of Concern and Vadose Zone Sediments
RL-SS23-S	Chemical Speciation and Complexation in Site-Specific Groundwaters
RL-SS24-S	Chemical Binding on Site-Specific Mineral Surfaces
RL-SS26-S	Reaction Rates for Key Contaminant Species and complexes in Site-Specific Groundwaters
RL-SS27-S	Rates of Coupled Abiotic and biogeochemical Reactions Involving Contaminants in Hanford Subsurface
RL-SS30-S	Remedial Technology for Cs Beneath Waste Tanks
RL-WT035-S	Moisture Flow and contaminant Transport in Arid Conditions
RL-WT053-S	Contaminant Mobility Beneath Tank Farms
RL-SS29	Develop Descriptions of Contaminant Flow and Transport in the Vadose Zone
RL-SS28-S	Rates of Colloid Formation and Colloidal Transport of Contaminants in Site-Specific Groundwaters
RL-SS29-S	Effect of Subsurface Heterogeneities on Chemical Reaction and Transport
RL-SS31-S	Mathematical Formulations of Chemical Reaction/Material Transport
RL-SS35-S	Use of Chemical surrogates for Contaminants
RL-WT053-S	Contaminant Mobility Beneath Tank Farms
RL-WT044-S	Distribution of Recharge Rates
RL-SS30	Understand and Quantify Water Movement in the Vadose Zone Using Uncontaminated Field Sites
RL-WT044-S	Distribution of Recharge Rates
RL-WT035-S	Moisture Flow and contaminant Transport in Arid Conditions
RL-SS31	Provide Advanced Characterization Tools and Methods to Delineate Contaminant Plumes in the Vadose Zone and Relate Plume Distribution of Geochemical and Hydrogeological Properties
RL-SS25-S	Chemical Form and Mobility of Dense, Non-Aqueous Phase Liquids in Hanford Subsurface Transport of Contaminants

Vadose Zone Element Index to Linked Needs.

RL-SS37-S	Chemical Sensor Principles
RL-SS25	Improved, Cost-Effective Methods for Sub-Surface Access to Support Characterization and Remediation
RL-SS26	Improved Methods for Determining Distribution of Beta Emitting Contaminants in Subsurface Soils
RL-WT026	Tank Leak Detection Systems for Underground Single-Shell Waste Storage Tanks (SSTs)
RL-WT102	Advanced Characterization Tools for Contaminants of Concern